

IN THE CLAIMS

1. (Currently Amended) An antenna element comprising:

a ground plane;

a cylindrical helix having a uniform pitch, the cylindrical helix being disposed above the ground plane, the cylindrical helix being connectable to a communications apparatus at a first helix end, ~~said~~the first helix end being located near the ground plane; and

~~a lateral~~spiraling inward in a flat configuration towards spiral ~~substantially centred on~~ the axis of the cylindrical helix, the spiral having a first end thereof connected to a second helix end, ~~said~~the second helix end being the opposite end of the cylindrical helix to the first helix end, said lateral spiral thereby terminating the antenna element wherein the axis of the cylindrical helix is substantially perpendicular to the ground plane, and the spiral lies in a flat plane that is substantially perpendicular to the axis of cylindrical helix.

2. - 3. (Canceled)

4. (Previously Presented) An antenna element according to claim 1, further including a tapered transmission line connected between the communications apparatus and the first end of the cylindrical helix located near the ground plane.

5. (Currently Amended) An antenna element according to claim 1, wherein:
the cylindrical helix has (a) between 1.5 and 3.5 turns, (b) a pitch angle of between 3 and 7 degrees, and (c) a circumference of between 0.9 and 1.15 wavelengths; and
the ~~lateral~~ spiral has between 1 and 4 turns.
6. (Currently Amended) An antenna element according to claim 1, wherein:
the cylindrical helix has (a) between 3.5 and ~~4.0~~ 4.0 turns, (b) a pitch angle of between 10 and 14 degrees, and (c) a circumference of between 0.9 and 1.15 wavelengths; and
the ~~lateral~~ spiral has between 1 and 4 turns.
7. (Previously Presented) An antenna comprising:
a switched element feed network having an equipment feed-line for connection to communication apparatus and a plurality of element feed-lines for connection to a like plurality of cylindrical helix antenna elements according to claim 1, said switched element feed network being adapted to connect a selected one of the cylindrical helix antenna elements to the communication apparatus; and
said plurality of cylindrical helix antenna elements, said cylindrical helix antenna elements being disposed above said ground plane, each said cylindrical helix antenna element being individually connectable at a respective said first helix end located near the ground plane to a respective element feed-line of the switched element feed network to thereby connect to the communications apparatus.

8. (Previously Presented) An antenna comprising:
a phased array feed network having an equipment feed-line for connection to communication apparatus and a plurality of element feed-lines for connection to a like plurality of cylindrical helix antenna elements according to claim 1, said phased array feed network being adapted to collectively connect said plurality of cylindrical helix antenna elements to the communication apparatus; and
said plurality of cylindrical helix antenna elements, said cylindrical helix antenna elements being disposed above said ground plane, each said cylindrical helix antenna element being individually connectable at a respective said first helix end located near the ground plane to a respective element feed-line of the phased array feed network to thereby connect to the communications apparatus.
9. (Currently Amended) An antenna according to claim 8, wherein:
the plurality of cylindrical helix antenna elements are arranged on a square grid in a domino pattern groups of five; and
each of the groups is arranged with (a) four members on grid intersection points of the grid and (b) a fifth member at the centre of the four members.
10. (Currently Amended) An antenna comprising:
a phased array feed network having an equipment feed-line for connection to communication apparatus and a plurality of element feed-lines for connection to a like plurality of cylindrical helix antenna elements, said phased array feed network being adapted to collectively connect said plurality of cylindrical helix antenna elements to the communication apparatus; and

said plurality of cylindrical helix antenna elements arranged in a pattern of domino pips, on a square grid in groups of five wherein each said group is arranged with (a) four members of the group on grid intersection points and (b) the fifth member of the group at the centre of said four members, each said cylindrical helix antenna element comprising a ground plane and a cylindrical helix having a uniform pitch disposed above the ground plane, each said cylindrical helix antenna element being individually connectable at a respective first cylindrical helix end located near the ground plane to a respective element feed-line of the phased array feed network to thereby connect said cylindrical helix antenna element to the communications apparatus, wherein each said cylindrical helix antenna element further comprises a ~~lateral~~ spiral spiraling inwards in a flat configuration towards substantially centred on the axis of the cylindrical helix the ~~lateral~~ spiral having a first end thereof connected to a second helix end being the opposite end of the cylindrical helix to the first helix end, said spiral thereby terminating the antenna wherein the axis of the cylindrical helix is substantially perpendicular to the ground plane, and the spiral lies in a flat plane that is substantially perpendicular to the axis of the helix.

11. (Currently Amended) An antenna according to claim 9, wherein:
in regard to a said group of five elements the radial inter-element spacing between the centre antenna element and antenna elements at on said corners ~~of the domino pattern grid intersection points~~ is between 0.5λ and 2.5λ at the frequency of operation of the antenna.

12. (Previously Presented) An antenna having two antennas according to claim 9, wherein:

a centre cylindrical helix antenna element of a first of said two antennas is co-located with a centre cylindrical helix antenna element of a second of said two antennas; and

the first of said two antennas is laterally rotated with respect to the second of said two antennas, said lateral rotation being about a common axis of the co-located centre cylindrical helix antenna elements to thereby change inter-element spacing between antenna elements of said two antennas.

13. (Currently Amended) An antenna comprising:

a ground plane;

a plurality of cylindrical helices disposed above the ground plane, each said cylindrical helix being connectable, via a respective feed line of an associated phased array feed network to a communications apparatus, at a respective first helix end located near the ground plane; and

a like plurality of ~~lateral~~ spirals, each spiraling inwards in a flat configuration towards substantially centred on the axis of the corresponding one of the plurality of cylindrical helices, said each lateral spiral having a first end thereof connected to a second helix end of the corresponding one of the plurality of helices, said second helix end being the opposite end of the cylindrical helix to the first helix end, said ~~lateral~~ spiral thereby terminating the corresponding helix;

wherein the axis of the cylindrical helix is substantially perpendicular to the ground plane, and the spiral lies in a flat plane that is substantially perpendicular to the axis of the helix.

14. (Currently Amended) An antenna comprising:

a ground plane;

a plurality of cylindrical helices disposed above the ground plane, each said cylindrical helix being connectable, via a respective feed line of an associated switched element feed network to a communications apparatus, at a respective first helix end located near the ground plane; and

a like plurality of ~~lateral~~ spirals, each spiraling inward in a flat configuration towards substantially centred on the axis of the corresponding one of the plurality of cylindrical helices, said each ~~lateral~~ spiral having a first end thereof connected to a second helix end of the corresponding one of the plurality of cylindrical helices, said lateral spiral thereby terminating the corresponding helix;

wherein the axis of the cylindrical helix is substantially perpendicular to the ground plane, and the spiral lies in a flat plane that is substantially perpendicular to the axis of the helix.

15. (Previously Presented) An antenna comprising:

a phased array feed network having an equipment feed-line for connection to communication apparatus and a plurality of element feed-lines for connection to a like plurality of cylindrical helix antenna elements, said phased array feed network being adapted to collectively connect said plurality of cylindrical helix antenna elements to the communication apparatus; and

said plurality of cylindrical helix antenna elements according to claim 1, said helix antenna elements being disposed above said ground plane and arranged in a rectangular grid pattern having a first spacing between rows of said rectangular grid pattern and a second spacing between columns of said rectangular grid pattern, each said cylindrical helix antenna element being individually connectable at a respective first helix end located near the ground plane to a respective element feed-line of the phased array feed network to thereby connect to the communications apparatus.

16. (Currently Amended) A method of impedance matching a cylindrical helix antenna element wherein the cylindrical helix antenna element comprises a ground plane, a cylindrical helix having a uniform pitch disposed above the ground plane, the cylindrical helix being connectable to a communications apparatus at a first helix end located near the ground plane, and a ~~lateral~~ spiral spiraling inward in a flat configuration towards substantially centred on the axis of the cylindrical helix the ~~lateral~~ spiral having a first end thereof connected to a second helix end, said second helix end being the opposite end of the cylindrical helix to the first helix end, said ~~lateral~~ spiral thereby terminating the cylindrical helix antenna, wherein the axis of the cylindrical helix is substantially perpendicular to the ground plane, and the spiral lies in a flat plane that is substantially perpendicular to the axis of the helix, said method comprising the steps of:

adjusting a distance, from the ground plane, of the first helix end located near the ground plane to thereby adjust the impedance of a tapered transmission line formed between the ground plane and a first quarter turn of the cylindrical helix.

17. (Currently Amended) An antenna according to claim 10, wherein:
having regard to a said group of five elements, the radial inter-element spacing between the centre antenna element and antenna elements at on said ~~corners of the domino~~ pattern grid intersection points is between 0.5λ and 2.5λ at the frequency of operation of the antenna.

18. (Previously Presented) An antenna having two antennas according to claim 10, wherein:
a centre cylindrical helix antenna element of a first of said two antennas is co-located with a centre cylindrical helix antenna element of a second of said two antennas; and
the first of said two antennas is laterally rotated with respect to the second of said two antennas, said lateral rotation being about a common axis of the co-located centre cylindrical helix antenna elements to thereby change inter-element spacing between antenna elements of said two antennas.